



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

**Branch: Electronics & Communication Engineering /
Information & Communication Technology**

Subject Code : DI05000071

Subject Name : Programmable Logic Controller & its Applications

w. e. f. Academic Year:	2026-27
Semester:	5 th
Category of the Course:	MOPEC

Prerequisite:	Basic knowledge of electrical circuits, digital logic, and fundamental instrumentation concepts such as sensors, signal types (analog/digital), and control system basics.
Rationale:	This course has designed for diploma students through which they can learn basic to intermediate theory & basic programming concepts of programmable logic controllers. PLCs are used in many industrial and commercial processes. A diploma holder in the industry is required to install, troubleshoot, program & modify PLCs and PLC-controlled systems. Looking at the industrial applications of PLCs in modern industry, this course finds its usefulness in the present curriculum.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Describe basic components of PLC and logical process in automation system.	U
2	Interface analog and digital input / output module with PLC.	U,A
3	Explain the basic concepts of PLC & ladder logic.	U
4	Use of timer, counter and other intermediate programming functions.	A
5	Develop basic entry-level applications and troubleshooting of PLC.	A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA(I)	ESE(V)	
2	0	2	3	70	30	20	30	150



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Course Content

Unit	Topics and Sub-topics	No. Of Hrs.	% Weightage
I	Introduction of PLCs. 1.1 Introduction to automation and control systems 1.2 Basics of PLC and its role in modern automation 1.3 Block diagram & architecture of PLC 1.4 Working principle of PLC 1.5 Selection Criteria of PLC 1.6 Application of PLC in the Industry. 1.7 Advantages and limitations of PLC. 1.8 Need of Automation in Industries.	5	24%
II	Peripherals and Interfacing 2.1 Peripherals devices of plc, Input Devices: Pushbutton, Limit switch, proximity switch, level switch, and other sensing devices. Output Devices: Relay, solid state relay, contactor, solenoid valve, and other controlling devices. 2.2 Ladder logic Symbols of PLC. 2.3 Introduction to Digital I/O and basic interfacing concept 2.4 PLC Input/output interfacing diagram.	6	12%
III	Basic of Programming techniques 3.1 Program scan & memory organization. a. PLC operation & program sequence. b. Memory organization and addressing basics c. Types of Register use in PLC (Holding, Input, Output register). 3.2 PLC Programming Languages. a. Ladder Logic (LAD) b. Functional Block Diagram (FBD) c. Structured Text (ST)	7	21%



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	3.3 Ladder diagram of all Basic Logic Gates. 3.4 Holding (latching relay) contact. 3.5 Concept of simple branching in Ladder logic.		
IV	Advance Programming functions 4.1 ON Delay timer, Off Delay timer, Retentive timer, non-retentive timer 4.2 UP Counter, Down Counter, UP-Down Counter 4.3 PLC arithmetic functions. (Addition, Subtraction, Multiplication, Square Root, Division, Negative 4.4 PLC comparison function (Equal, not equal, less than, greater than or equal, limit test function) 4.5 Data handling instructions: Move, Block Move, Table Move, Register Move.	7	29%
V	Application and Troubleshooting 5.1 PLC-based automation system. 5.2 High-Low level control of the tank. 5.3 DC motor control using PLC. 5.4 Two-way traffic lights system. 5.5 Troubleshooting procedure of PLC.	5	14%
	Total	30	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
30	30	40			

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Programmable logic Controllers Principles and applications	John W. Webb Ronald A Reis	PHI Learning,



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2	Programmable logic Controllers Programming methods and applications	John R Hackworth Frederick D. Hackworth Jr.	Pearson
3	Process Control Principles and applications	Surekha Bhanot	Oxford University press
4	Instrumentation engineer's handbook	B. G. Liptak	Chilton Book Co., Philadelphia
5	Process control Instrumentation technology	Curtis D Johnson	PHI pvt. Ltd.
6	Programmable Logic Control: Principles And Applications	NIIT	PHI EEE edition
7	Programmable Controllers	Thomas A. Hughes	ISA

(b) Open source software and website:

- www.control.com
- www.plcs.net
- www.seimens.com
- www.triplc.com
- https://instrumentationtools.com
- theautomationblog.com
- www.plccompare.com
- www.plcdev.com
- www.plcprogramming.com
- https://plcmanual.com/
- https://plcacademy.com
- https://realpars.com/plc
- www.plcgurus.net

Suggested Course Practical List

The following practical outcomes (PrOs) that are the sub-components of the COs. *Some of the PrOs marked '*' are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

S.No.	Practical Outcomes (PrOs)	Approx. Hrs. required
1	Study of PLC software/simulator interface.	2*



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2	Identify various modules and component of PLC hardware.	2
3	Learn the basics and hardware components of PLC.	2
4	Sketch PLC based automation system with example.	2
5	Identify various peripherals which are interface with PLC.	2
6	Draw basic ladder logic symbols for PLC & determine DI/O and AI/O for given problem	2
7	Draw wiring Diagrams for Digital Input (DI) and Digital Output (DO) signals for PLC.	2
8	Draw wiring Diagrams for Analog Input (AI), and Analog Output (AO) signals for PLC.	2
9	Describe the method of program scanning in PLC.	2
10	Implement a simple ladder logic program using digital inputs and outputs for PLC.	2
11	Develop ladder logic to test functionality of basic logic gates.	2
12	Implementation of simple ladder logic program using timer.1) On delay timer 2) Off delay timer 3) Retentive timer	2
13	Implementation of simple ladder logic program using Counter 1) Up Counter 2) Down Counter	2
14	Simulate ladder logic for Industrial application on UP counter.	2
15	Simulate Industrial application of Arithmetic Function for plc.	2
16	Simulate Industrial application of PLC Data Transfer Functions.	2
17	Simulate Industrial application of Comparison Functions.	2
18	Write and implement ladder logic program to blink LED using timer.	2
19	Write and implement ladder logic program to on-off the DC motor using PLC	2
20	Implement traffic light control system using PLC.	2
21	Simulate Bottle filling process on PLC simulator. Draw connection details for the same process.	2
	Total:	42 Min. 30 Hrs

Note

- More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list. **Institute will select 15 practicals considering 1 to 11, any two from 12 to 17 and any two from 18 to 21 for balancing 30 hrs and PrOs.**
- The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
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1	Conceptual clarity.	20
2	Experimental setup, Procedure and conduction by following safety practices.	50
3	Interpretation of Results and Ethical values.	30
Total		100

List of Laboratory/Learning Resources Required

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to use in uniformity of practical's in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	D.C. power supply, Multi-meter, Breadboard, patch cord.	11 to 22
2	Computer system with latest operating system.	11 to 22
3	PLC trainer kit.	11 to 22
4	8 Digital input/output PLC with SMPS & required cables.	3,11 to 22
5	Digital and analog module.	3,4,5,7
6	Level, flow, proximity and limit switch.	3,4,5,7
7	License/Free copy of ladder logic editor.	11 to 22
8	Simulator software for virtual simulation.	11 to 22
9	Level, flow, pressure control trainer kit.	1,2,3, 11 to 22
10	DC motor, solenoid valve, relay and other switching devices.	3,4,5,22

Suggested Project List:

Only one project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth semester**, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contributions in the project work and give a seminar presentation of it before



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submission. The duration of the micro project should be about **12-14 (fourteen to sixteen) student engagement hours** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

- a) Make a working model of traffic light control using PLC.
- b) Make a working model of elevator using PLC.
- c) Make a working model of Automatic Car Parking System-multi Level.
- d) PLC Based Automatic Bottle Filling Application.
- e) PLC Based Door Open and Closing System.
- f) PLC Based Automatic Counting System.
- g) PLC Based Level Control System.
- h) PLC Based Automatic Mixing Applications.
- i) Collect specifications from different manufacturers of PLC and prepare a market survey report.

Suggested Student Activities

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should perform following activities in group (or individual) and prepare reports of about 5 pages for each activity. They should also collect/record physical evidence for their (student's) portfolio which may be useful for their placement interviews:

- a) Present seminar on various topics from course content
- b) Prepare poster of PLC based automation system.
- c) Mini project for industrial application using PLC
- d) Subject Coordinator arrange Industrial Visit to any nearby automation plant in which PLC automation is there, students have to prepare report for it.

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